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The banner is blue with white text. On the left, it says "Energy Saving". In the center, there is a box labeled "League Challenge". To the right, there are two icons: a person icon labeled "1 Person" and a robot icon labeled "1 Robot", with the word "Participation" above them. On the far right, it says "Construction On Site".

1. Game Description

Energy Saving Robot provides an opportunity for students to use their knowledge, skill and creativity to build a robot, where the robot has ability to follow the line using light source energy from the solar cells and capacitor banks.

2. Robot

2-1. Type of robot: No restriction

2-2. Construction (Built on-site)

The robot should be built on-site by the participant during the construction time except for the controller module of robot, capacitor module, wire joint connected with solar panel and wire joint connected with capacitor. These things are allowed to pre-made. There is no restriction on composition.

2-2-1. Size of robot: No restriction. If participate use oversized robot such that cannot play in the assigned playground, it won't participate in this category.

2-2-2. Match is divided into Junior and Challenge

- 1) Junior league: Driving along the installed guide walls of playfield without using the program. A robot that drives the furthest wins the game during the limited time.
- 2) Challenge league: It is autonomous driving using the program; a robot traces the line in the playfield.

2-2-3. Power source on robot

Robots should work with an solar power supply by the artificial sunlight(halogen light) provided in playfield A; it cannot use a combustibile device. It is no allowed for robot to use additional battery.

2-2-3-1. Solar cells: Less than 150mm x 150mm

2-2-3-2. Capacitor bank: It is allowed to use 1 super capacitor bank which are 2 farad.

If participant wants to use 2 capacitor, it should be less than 1 farad. Otherwise,

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it won't be allowed.

2-2-4. Operation: No restriction

2-3. Programming and control: Robot must move autonomously except the starting point and it cannot be operated by the outside. The course will be announced on the day of match.

3. Competition Site

3-1. Official Playfield: It must get an approval from International Robot Olympiad committee.

3-2. Size and Composition: Two blocks with size 160cm x 120cm ($\pm 10\%$) are connected.

3-2-1. Connection: The size of bridge has to be 25cm ($\pm 10\%$). The bridge could connect to both playfields with straight line or curve line, sticked with tapes and paper sheets and the playfields could be connected directly.

3-2-2. Less than 2° gradient ($\pm 10\%$) is possible to exist in site. Less than 0.3cm ($\pm 10\%$) irregularity or crack is possible to exist in site.

3-2-3. Outer acrylic wall will not be installed to prevent fall of the robot. But, there will a guide wall for their run.

3-3. Playfield: It is cover with matt coat polyethylene terephthalate paper which includes advertisement and logo from the organizers.

3-3-1. Mission Map: There is a mission map with 10cm square grids and it is fixed with sheets and tapes in the playfield. Square grids from start line will present the points when a participant scoring.

3-3-2. Driving course: Driving course is displayed as lines. It consists of connection of straight line and curve line and fix with sheets and tape on the field.

3-3-3. Line: The color of line is black width of 2cm ($\pm 10\%$)

3-4. Artificial sunlight (halogen light): It will be installed in A playfield as artificial sunlight. There won't be any artificial sunlight in B playfield.

3-4-1. Allocation of artificial sunlight (halogen light): Stand artificial lights are fixed on the side of the stadium or are installed in form of a structure.

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3-4-2. Standards of artificial sunlight (halogen light): It will be more than 45wh, less than 250wh and it will be announced on the day of match.

4. Competition progress

4-1. Game process

There will be recorded trials twice and after first trial there will be some modification time.

4-2. Construction and practice time

Construction and practice time is more than 30 minutes, less than 120 minutes and it will be announced on the day of match.

4-3. Allocation of playfield

It will allocate based on number of participant and level of difficulty of the game.

4-4. Construction and Practice

Participants can do the practice until the end of announced practice time, however it is not allowed to practice before the playfield is assigned.

4-5. End of Production and Practice time

After production and practice time, participants must stop their robot and follow the instruction of referee and staffs.

4-6. 1st Run

After the construction and practice time the 1st run will begin.

4-6-1. preparation of the game

All participants have to take their robot out and be ready from referee and staff's instruction.

4-6-2. Standby after the game

When participant finished their 1st run, they have to line up and watch all participants' game until end of that trial.

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4-7. Repair Time

After the end of 1st run, all participants have 30 minutes to repair their robot and practice.

4-8. 2nd Run

Right after the repair time, 2nd Run will begin.

4-8-1. preparation of the game

All participants have to take their robot out and be ready from referee and staff's instruction.

4-8-2. Stand by

If a participant finishes his/her 2nd trial, they will go back to their seats.

5. Competition

5-1. Perform the mission

5-1-1. A playfield: **After referee's signal, participant should turn on its switch. After this, it is not allowed to touch their robot. If participant push their robot physically or turn on its switch again, it will be disqualified. Robot drives the course and it must get out of A playfield within 30 seconds. Robot has to accumulate as much energy as possible in the capacitor banks.**

5-1-2. B playfield: Robots use only the accumulated energy in the capacitor banks to drive the course.

5-2. Points

It will be counted as the points of destination where robot stopped.

5-3. Start

A participant should start the robot when the referee starts the game. Referee records the time for robot with a stopwatch.

5-3-1. Discharge of condenser: Before starting match, participants should discharge of their condenser. Referee will check whether their robots move before the match.

5-4. Arrival

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The robot arrives at the arrival point and it has to stop time of referee's stopwatch.

5-5. Time limit

The time limit in A playfield is 30 seconds. Including this 30 seconds, the total match time is 2 minutes.

5-6. Opening the mission

All missions including structure of playfield and bridge, course, location of artificial lights and etc. will be announced on the day of match.

5-7. End of Competition

If robot could not continue match, referee will announce the match is over.

5-7-1. A Playfield: If a participant exceeds the time limit (30seconds), the match will be over and the result will be the point when it finished. For A playfield, referee will not declare Robot Stop even if robot stops within 30 seconds.

5-7-2. B playfield

Robot Stop: If the robot which accesses in B playfield doesn't move, the referee will count 10 seconds and if the robot still could not move call it a stop and count the points before reaching the end point.

5-7-3. Robot arrival

If robot arrives at the finishing line in B playfield, the match is over and records the points and time when it is finished.

5-7-4. TKO (technical knockout): During the match, referee can declare of TKO without 10 counts when referee judge that the robot can't drive properly anymore. (Ex. robot had been stopped over the structure and obstacle, robot drive settled zone repeatedly).

5-8. End of the match due to disqualification

During the match, when participant violate the rule or making interruption the match will be ended but result will not be admitted.

5-8-1. Robot Touch

During the match, participants touch the robot without judge and supervisor authorization it will be robot touch and disqualified.

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5-8-2. Repair time during the match

During the match, additional, remove, exchange, changing the toll is prohibited but during the standby to repair the robot the participants has additional battery then the team will be disqualified.

5-8-3. Disobey of allocating the seat

If participant practice or play the game without allocated playfield, participant will be disqualified.

5-9. Rematches

During the match when it had been black out happens referee and coach can make a decision to do rematch.

5-10. Referee will control all situations from and referee have authority to control participants. The judgment of game result is exclusive authorization of referee. The declaration shall be final.

6. Evaluation

6-1. Ranking decision factors

Mission points of each course and time record

6-2. Mission points

When referee declare the end of the game, the mission points will be recorded as the points of destination where robot stopped. At this time, the highest score of the front wheel will be recorded as final point.

6-3. Time record

Time record is based on the referee's stopwatch when robot passes the finish line. (If you are declared as TKO, Robot stop and robot falls by referee, it will not be recorded.)

6-4. Final score

Better score out of 1st and 2nd run will be the final score.

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6-5. Order of priority to result

If a robot arrives at the arrival point, they will get the full points. If there are tie, result has to be decided by their time record. If a robot doesn't arrive at the arrival point, result has to be decided by their time record to the stop.

6-5-1. Order of priority according to present

If is same result in the present time then the referee needs to look the other time of the record and decided the result.

6-5-2. Order of priority according to Tie-Breaker

In order to sum up the best result from first and second chance, if it's a tie it will be 1st to be in best rank.

